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(54) Title: METHOD AND MEMORY FOR TRANSACTING FUEL PURCHASES USING AN ISLAND TRANSACTION TERMINAL			
(57) Abstract			
<p>A method and computer-readable memory encoded with executable instructions for transacting fuel purchases using an island transaction terminal which controls a plurality of fuel dispensing pumps interconnected to the island transaction terminal through a central attendant terminal. Whether one of the plurality of fuel dispensing pumps is already reserved by another island transaction terminal or by a central attendant terminal is determined. Money or a money equivalent is accepted at the island transaction terminal for a fuel purchase. The requested fuel dispensing pump is automatically enabled to dispense fuel upon verification of the money or money equivalent acceptance.</p>			

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METHOD AND MEMORY FOR TRANSACTING FUEL PURCHASES  
USING AN ISLAND TRANSACTION TERMINAL

Field of the Invention

The present invention relates to a method and memory for transacting fuel purchases using an island transaction terminal and, in particular, to a method and memory for transacting fuel purchases using an island transaction terminal comprising a cash payment acceptor and a non-cash payment acceptor.

Background of the Invention

Prior to pay-at-the-pump technology, gasoline service stations were typically equipped with an attendant-operated terminal for manually transacting fuel purchases. This type of terminal was ordinarily situated in a central location, normally the sales office, and self-service customers were required to pay for gasoline at this location. So long as each fuel dispensing pump was "enabled" that is, ready for pumping without attendant intervention, to purchase gasoline, a customer merely had

to park his car at one of the fuel dispensing pump islands, pump the gasoline and then walk to the central location to pay for the gasoline purchase.

However, the problem of "drive-offs" often required service station operators to avoid leaving the fuel dispensing pumps in a normally enabled state. A "drive-off" occurred whenever a car refuelling at a remote, enabled fuel dispensing pump drove off without paying for the gasoline. This situation led to the installation of equipment to remotely enable the fuel dispensing pumps from the central location and requiring the customer to make a pre-payment for gasoline before the attendant enabled the pump.

As a result, the customer now had to park his car at one of the fuel dispensing pump islands and walk to the central location to tender pre-payment by cash, debit card, credit card and the like. After making the pre-payment, the customer would walk back to the pump island and dispense the gasoline. After the fuel dispensing was done, the customer would return to the central location to complete the sales transaction by obtaining any change due, picking up a cash receipt, signing a credit card slip or performing any similar action. The procedure was time consuming and inconvenient to the customer and frequently resulted in lost sales to the service station operator.

Consequently, the option of paying for fuel purchases at the pump without the need to walk to the central location for pre-payment or post-pumping wrap-up has become increasingly popular to the motoring public. Such a point of service system allows for payment using a customer credit card and can automatically enable fuel dispensing pumps directly from a fuel dispensing pump island. Such systems are described in U.S. Patent Nos. 4,395,626 and 4,395,627 both issued to Barker et al. on July 26, 1983. The Barker devices provide a step forward in the art by permitting self-vending of fuel, self-payment and self-

enablement of individual fuel dispensing pumps by the customer. The Barker devices, however, do not accept cash and are limited to accepting customer credit cards and the like. A customer desiring to pay for a fuel purchase with cash must still make two trips to the central location for pre-payment and for obtaining any change due and a receipt.

There are several problems in equipping such pay-at-the-pump terminals with cash acceptors. First, most fuel dispensing pumps are available in either single or multiple product configurations for selling one or more grades of gasoline. Although the housings of these dispensers can be modified to incorporate pay-at-the-pump terminals, their limited size, especially those of the single product varieties, often make it difficult to add further feature modules, such as cash acceptors.

In addition, cash acceptors typically include a removable cartridge into which received paper currency is stored for later retrieval by authorized personnel. Equipping every fuel dispensing pump with a cash acceptor is very expensive and creates a substantial potential for robbery during the cash cartridge retrieval process. Armoured security car companies can perform this function and their insurance premiums are based, in part, on the number of individual locations at which a cash pickup must be made. Since each individual pump constitutes a single pickup location, the insurance premiums for armoured car pickup at each individual pump become significant and make cash pickup commercially impracticable.

Therefore, what is needed is a separate, free-standing, customer-operable point-of-sale terminal providing a cash payment acceptor and a non-cash payment acceptor, such as a debit or credit card acceptor, situated on each fuel dispensing island for transacting fuel purchases for a plurality of fuel dispensing pumps without requiring the customer to travel unnecessarily back and forth between the fuel dispensing island and the

central location. Desirably, such a terminal should be an individual self-contained unit that does not need to be mounted in a fuel dispensing pump housing and yet is configurable to minimise the number of pickup locations for cash cassette retrieval and for transferring to a bank.

Summary of the Invention.

Accordingly, the present invention provides a method and memory for transacting fuel purchases using an island transaction terminal comprising a cash payment acceptor and a non-cash payment acceptor.

An embodiment of the present invention is a method and computer-usable memory encoded with executable instructions for transacting fuel purchases using an island transaction terminal which controls a plurality of fuel dispensing pumps interconnected to the island transaction terminal through a central attendant terminal. Whether one of the plurality of fuel dispensing pumps is already reserved by another island transaction terminal or by a central attendant terminal is determined. Money or a money equivalent is accepted at the island transaction terminal for a fuel purchase. The requested fuel dispensing pump is automatically enabled to dispense fuel upon verification of the money or money equivalent acceptance.

An embodiment of the present invention is also a method for transacting fuel purchases on a fuel dispensing island using an island transaction terminal comprising a cash payment acceptor and a non-cash payment acceptor. A pump number for identifying one of a plurality of fuel dispensing pumps at the island transaction terminal is accepted. Whether the fuel dispensing pump corresponding to the pump number is already reserved by another island transaction terminal or by a central attendant terminal is determined. The corresponding fuel dispensing pump is reserved. A cash or non-cash payment is accepted at the island transaction terminal. The corresponding fuel

dispensing pump is automatically enabled to dispense fuel.

Still other embodiments of the present invention will become readily apparent to those skilled in the art from the following detailed description, wherein is shown and described only embodiments of the invention by way of illustration of the best modes contemplated for carrying out the invention. As will be realized, the invention is capable of other and different embodiments and its several details are capable of modification in various obvious respects, all without departing from the spirit and scope of the present invention. Accordingly, the drawings and detailed description are to be regarded as illustrative in nature and not as restrictive.

Brief Description of the Drawings

FIG. 1 is a perspective view of a gasoline service station incorporating the method and memory of the present invention;

FIG. 2 is a functional block diagram of a system constructed in accordance with the present invention;

FIG. 3 is a side view of a point-of-sale terminal for an island transaction terminal;

FIG. 4 is a functional block diagram of the point-of sale terminal of FIG. 3;

FIG. 5 is a functional block diagram of a controller device for the system of FIG. 2;

FIGS. 6A, 6B, 6C and 6D are a flow diagram of a method for transacting fuel purchases using an island transaction terminal in accordance with the present invention;

FIG. 7 is a flow diagram of a procedure for printing a receipt for the method of FIGS. 6A, 6B, 6C and 6D; and

FIGS. 8A, 8B and 8C are flow diagrams depicting asynchronous event handler routines for the method of FIGS. 6A, 6B, 6C and 6D.

Detailed Description

FIG. 1 is a perspective view of a gasoline service station 11 incorporating the system of the present invention and having a plurality of gasoline dispensing islands 14 and 15. Each island is shown comprising three separate gasoline dispensing pumps 14a, 14b, 14c, 20a, 20b, 20c, although any number of pumps may also be used. Each pump is conventional in the art and is capable of remote enablement from a central master terminal 19 positioned within gasoline station 11 or from an island transaction terminal 17. Each pump has at least one fuel dispensing outlet for dispensing a particular grade and type of fuel, for example, diesel, unleaded premium or regular gasoline, etc., independently of each of the other pumps, and has a sensor for detecting when the pumping operation has completed, for instance, when the pump nozzle has been returned to the housing. In the described embodiment, the fuel dispensing pumps 14a, 14b, 14c, 20a, 20b, 20c are of the single or dual product dispenser type wherein each hose pumps only a single or two kinds of fuel, although other types of fuel dispensing pumps may also be used.

In addition, each island 13, 15 has an island transaction terminal 17, 18 for controlling fuel dispensing pumps and preferably comprising back-to-back point-of-sale terminals. Island transaction terminals 17, 18 are each shown in as a free-standing housing situated independently from the structure of the gasoline station 11 and from the fuel dispensing pumps. However, the island transaction terminals can also be installed around a support post, such as one of the support posts for the canopy covering the fuel dispensing islands. Each island transaction terminal preferably comprises two point-of-sale terminals, such as shown in FIG. 3, on opposite sides of the housing. Preferably, the island transaction terminal 17 is positioned within each gasoline dispensing island 13 with the point-of-sale terminals oriented transverse to the flow

of automobile traffic through the islands. This enables a customer to step onto a gasoline dispensing island and out of the flow of traffic and thereby ensures safe operation of the island transaction terminal.

Underground cables 16a, 16b, 16c, 21a, 21b, 21c provide communication between the master terminal 19 and each of the fuel dispensing pumps 14a, 14b, 14c, 20a, 20b, 20c and underground cables 22a, 22b provide communication between the master terminal 19 and each of the island transaction terminals 17, 18. A transmission cable 23 connects the master terminal 19 to a data bank (not shown) for transmission and receipt of credit, debit and related sales information.

FIG. 2 is a functional block diagram of a system constructed in accordance with the present invention. Except as otherwise noted, each of the components is further described hereinbelow.

The primary control hub is provided by the attendant-controlled master terminal 19. An example of a console suitable for use in the present invention is the SM-960 Control Console manufactured by Suntronic Technology Group, Crystal Lake, Illinois.

The master terminal 19 acts as the master control console and performs several functions. First, it performs the cash registering functions associated with the sale of gasoline and merchandise, including accepting cash, debit cards, credit cards and the like, using a built-in keypad, alphanumeric display and associated logic (not shown). This includes remotely enabling the fuel dispensing pumps for dispensing fuel upon attendant request so that fuel may be dispensed. The back panel of the master terminal 19 is equipped with a plurality of serial ports preferably operating in accordance with the Electronic Industries Association EIA RS-485 serial interface standard for connecting the master terminal 19 to various devices. Each of these serial ports (as shown) is associated with a

different function, although in practice, every serial port might not necessarily be in use or might perform identical functions.

A slave attendant terminal 28 is connected to the master terminal 19 for providing a second attendant-controlled console to the attendant or an assistant via serial cable 39. The slave attendant terminal 28 performs basically identical cash registering functions as the master terminal 19, including remote pump enablement, except that master terminal 19 acts as the master console for receipt journaling purposes and resolves pump reservation conflicts. A similar set of serial ports is also provided on the slave attendant terminal 28.

Pin pads 40a, 40b are connected to both the master terminal 19 and the slave terminal 28 for enabling customers to enter PIN codes in conjunction with debit card, credit card and similar transactions wherein a security code is required for card authorization. Molded connector 42a, 42b are provided on the ends of serial cables 41a, 41b, 43a, 43b to enable pin pads 40a, 40b to be disconnected from the master terminal 19 and the slave terminal 28. An example of a pin pad suitable for use with the present invention is a Verifone Model 201 Pin Pad, manufactured by Suntronic Technology Group, Crystal Lake, Illinois.

Journal printers 46a, 46b are also connected to the master terminal 19 and the slave terminal 28 via serial cables 47a, 47b, respectively, for printing out specific accounting information accumulated throughout each day, week, month or other particular time period established by the operator of the gasoline station. The journal printers 46a, 46b are conventional in the art, such as described in U.S. Patent 4,199,100 issued to Wostl et al. on June 8, 1978, the disclosure of which is hereby expressly incorporated herein by reference.

A network modem 36 is connected to the master terminal

19 via a serial cable 37 for interfacing the master terminal 19 to a remote data bank via the transmission cable 23 (not shown) for verifying debit cards, credit cards and the like. One useful system is described in U.S. Patent Nos. 4,395,626 and 4,395,627 issued to Barker et al., the disclosures of which are hereby expressly incorporated herein by reference.

A store automation system 32 is connected to the master terminal 19 via a serial cable 34 for recording the point-of-sale transactions and providing an accounting to a remote centralized host computer.

Each of the fuel dispensing pumps 14a, 14b, 14c, 20a, 20b, 20c are connected to the master terminal 19 via a serial cable 27. In the described embodiment, a junction box 31 for providing optoisolation is situated within the gasoline station 11 into which the serial cable 27 and the underground cables 16a, 16b, 16c, 21a, 21b, 21c are connected. An example of a junction box 31 suitable for use in the present invention is the 67B interface box manufactured by Tokheim Corporation, Fort Wayne, Indiana. Other means of interconnecting the master terminal 19 to the plurality of fuel dispensing pumps 14a, 14b, 14c, 20a, 20b, 20c, 14a, 14b, 14c may also be used.

A controller device 24 interfaces the master terminal 19 to the island transaction terminals 17, 18 by providing protocol translation and status and control signal transmissions. In the described embodiment, a junction box 30 for providing optoisolation is situated within the gasoline station 11 into which the serial cable 26 and the underground cables 22a, 22b are connected. An example of a junction box 30 suitable for use in the present invention is the 69B interface box manufactured by Tokheim Corporation, Fort Wayne, Indiana. Other forms of interconnecting the interface unit 24 to the island transaction terminals may also be used.

Preferably, the controller device 24 is connected to

a uninterruptible power supply (UPS) (not shown) for providing standby power to the controller device 24 in case of power outage. A serial cable 38 is connected to the UPS for monitoring the status of the power source. The UPS indicates to the controller device 24 over the serial cable 28 the occurrence of a power outage and subsequent transferral to battery backup power.

FIG. 3 is a side view of a point-of-sale terminal for the island transaction terminal 17 of FIG. 2. It comprises a liquid crystal display (LCD) 50, a key pad 51, a cash acceptor 52, a card reader 53, and a receipt printer 54. In the described embodiment, the LCD display 50 has a character display with four 20-character rows and the keypad 51 has 16 keys. Other sizes of displays and keypads are equally acceptable so long as they incorporate the functionality recited herein. Other suitable arrangements of the components shown may also be used.

FIG. 4 is a functional block diagram of the point-of-sale terminal 49 of FIG. 3. A processor board 57 for controlling the point-of-sale terminal 49 interfaces via internal control lines to the cash acceptor 52, the magnetic card reader 53, the receipt printer 54, an audio transducer 58 and a data encryption module 59. The island transaction terminal 17 operates as a complete unit, sending control signals to the controller device 24 and status signals to the dispenser controller (not shown). In the described embodiment, the magnetic card reader 53 enables a customer to use a debit card; however, credit cards and "smart" cards may also be used. Also, the cash acceptor 52 accepts and stores cash; however, a combination cash acceptor/cash dispenser may also be used to both accept cash and to provide cash back directly at the island transaction terminal 17. Both the cash acceptor 52 and the magnetic card reader 53 are configured as input devices to the processor board 57. The receipt printer 54 indicates low paper and out-of-paper conditions to the processor

board using a paper sensor signal line. Additionally, the processor board 57 sends receipt data to the receipt printer 54 over the receipts signal line. In the described embodiment, the receipt printer 54 is equipped with a tear bar (not shown) for manually tearing a printed receipt out of the receipt printer 54. However, the receipt printer 54 can optionally be equipped with an automatic receipt cutter for cutting a printed receipt upon the assertion of a cutter signal sent to the receipt printer 54 over the cutter signal line. To aid the operation of the point-of-sale terminal 49, an audio transducer 58 is preferably provided for providing auditory feedback to a customer during use.

To interact with a commercial data bank provider for verifying debit card and credit card transactional information, the LCD display 50 and the key pad 51 are preferably integrated into the data encryption module 59 which interfaces directly to the processor board 57. In the described embodiment, the data encryption module 59 conforms to the derived unique key per transaction (DUKPT) data encryption standard. When a customer enters a PIN using the key pad 51, the data encryption module 59 encodes the key strokes and sends the encoded PIN as an encrypted packet to the processor board 57 for transmission to the master terminal 19.

Fig. 5 is a functional block diagram of the controller device 24 of FIG. 2. A power supply 81 provides power to the controller device 24 and is preferably connected to the UPS (not shown) for providing standby power in the case of a power failure. The controller device 24 includes a processor board 80 containing a plurality of serial parts 82, preferably a network port 83, a microprocessor 84, random access memory (RAM) 85 and a programmable read only memory (PROM) 86. An image of the fuel dispensing pump reservations is stored in the RAM 85 for use in determining whether one of the plurality of fuel dispensing pumps 14a,

14b, 14c, 20a, 20b, 20C is already reserved by another island transaction terminal 18 or by the master terminal 19 (or slave terminal 28). An example of a controller device 24 suitable for use in the present invention is the Model SI-1000 Dispenser Authorization Terminal Controller manufactured by Suntronic Technology Group, Crystal Lake,

Illinois. Preferably, the microprocessor 84 is an Intel 80386 microprocessor manufactured by Intel Corporation. The preferred size of RAM is one megabyte and the PROM is used for storing firmware operating instructions. The serial ports 82 preferably operate in accordance with the Electronic Industries Association EIA RS-485 serial interface standard. The network port 83 is an ethernet connector and which preferably operates in accordance with the IEEE 802.3 standard.

FIGS. 6A, 6B, 6C and 6D are a flow diagram of a method for transacting fuel purchases using an island transaction terminal 17 in accordance with the present invention. The status of the debit card reader 53 and the cash acceptor 52 are determined by the processor board 57. If both devices are not working (block 100), a prompt "OUT OF SERVICE 0" is displayed on the LCD display 50 (block 101) for indicating to the customer that the island transaction terminal 17 is not in service (the number "0" indicates the type of error condition). For example, the cash acceptor 52 could be offline due to a full cash storage cartridge, a jammed bill, a removed cartridge, an improperly installed cartridge, an armored car pickup in progress, etc. The card reader 53 could be offline due to a down data bank communications line or for another reason.

If either the debit card reader 53 or the cash acceptor 52 are working (block 100), a two-step sequence is followed by the processor board 57 for determining an appropriate prompt. First, if the processor board 57 determines that the cash acceptor 52 is offline (block

103), a prompt "ENTER PUMP # CASH OFFLINE" is displayed on the LCD display 50 (block 104) for indicating to the customer that the cash acceptor 52 is offline and unavailable. Otherwise, if the processor board 57 determines that the cash acceptor 52 is not offline (block 103) and yet the debit acceptor (card reader) 53 is offline (block 105), a prompt "ENTER PUMP # DEBIT OFFLINE" is displayed on the LCD display 50 (block 106) for indicating to the customer that the debit card reader 52 is offline and unavailable. However, if both devices are not offline (blocks 105, 107), a prompt "ENTER PUMP #" is displayed on the LCD display 50 (block 107). For security reasons, the prompts in blocks 104, 106 and 107 are injected into the LCD display 50 by the data encryption module 59.

Regardless of which prompt is displayed, the customer must select one of the plurality of fuel dispensing pumps 14a, 14b, 14c, 20a, 20b, 20c by entering a pump number using the keypad 51 and the processor board 57 stores the pump number for later use (block 108). Unless otherwise indicated, the processor board 57 waits for a customer response on the keypad 51 for a fixed period of time and, upon the expiration of the time period (called "timing out"), proceed to the next step in the process. In the described embodiment, the customer is given three seconds in which to respond. If the processor board 57 times out while waiting for the customer to enter a pump number (block 109), control returns to the top of the flow chart and the sale is cancelled.

Assuming no time out occurs (block 109), the processor board 57 sends a pump reservation request containing the pump number to the controller device 24 for determining whether the requested pump number is already selected by another island cashier 18 or by the master terminal 19 (or slave terminal 28). The microprocessor 84 examines the image of the fuel dispensing pump reservations stored in the RAM 85 and sends an appropriate acknowledgement to the

processor board 57 indicating whether the pump is already in use. If the pump number is already selected by another island cashier 18 or the master terminal 19 (or slave terminal 28) (block 110), a prompt "PUMP IN USE" is displayed on the LCD display 50 (block 112) indicating to the customer that the pump is not available, control returns to the top of the flow chart and the sale is cancelled. Otherwise, if the pump is available (block 112), the master terminal 19 reserves the pump and updates the image of the fuel dispensing pump reservations stored in the RAM 85.

If the pump number is not already selected (block 110), a prompt "RECEIPT? [YES/NO]" is displayed on the LCD display 50 (block 111) to inquire whether a receipt is desired for the present transaction. The customer must answer by pressing the receipt key on the keypad 51. The processor board 57 can time out while waiting for the customer to press the receipt key or the yes key or the no key can be pressed (block 113). Regardless, control continues on to the next step.

If the cash acceptor 52 is full, jammed or offline for any other reason (block 114), a prompt "INSERT CARD" is displayed on the LCD display 50 (block 115) indicating to the customer that a debit card is the only form of payment available. Otherwise, if the cash acceptor is online (block 114) and yet the debit card reader 53 is offline (block 116), a prompt "INSERT BILL" is displayed on the LCD display 50 (block 117) indicating to the customer that cash is the only form of payment available. Otherwise, if both the cash acceptor 52 and the card reader 53 are online (blocks 114, 116), a prompt "INSERT CARD OR BILL" is displayed on the LCD display 50 (block 113) indicating to the customer that both cash and a debit card are acceptable forms of payment.

Two paths of control are now followed: cash acceptance (beginning with block 124). The cash

acceptance control path is the only available path when the debit card reader 53 is offline. Likewise, the debit card acceptance control path is the only available path when the cash acceptor 52 is offline. However, either control path is available if the cash acceptor 52 and the debit card reader 53 are operational and the control path desired is select by the customer who inserts either a debit card or cash at his or her option.

The cash acceptance control path will be discussed first.

The processor board 57 waits (for about five seconds in the described embodiment) for a bill to be inserted into the cash acceptor 52. If the processor board 57 times out (block 119), control returns to the top of the flow chart and the sale is cancelled. Otherwise, if a bill is inserted (block 119), the cash acceptor 52 accepts the cash and, upon determining its denomination, indicates to the processor board 57 the amount of cash accepted (block 120). However, if the cash acceptor 52 determines that the bill is unacceptable, for instance, because the bill is a forgery or a worn out bill, it will automatically reject the bill. Upon cash acceptance (block 120), the processor board 57 sends a message to the controller device 24 indicating that cash has been accepted by the cash acceptor 52 and the controller device 24 updates a tally of the amount of cash received. A prompt "TOTAL \$-.00 ENTER TO END" is displayed an LCD display 50 (block 121) indicating to the customer the current total of cash received and that the enter key on the keypad 51 should be pressed to end the cash acceptance cycle.

Prior to accepting any further bills, the processor board 57 determine whether the cash limit has been reached. In the described embodiment, a limit of \$50.00 is used; however, other appropriate limits could be programmed into the system as desired. If the cash limit has been reached (block 122), the cash acceptance cycle (blocks 120-123) is

exited. Otherwise, if the cash limit has not been reached (block 123) and another bill has been inserted into the cash acceptor 52, the cash acceptance cycle (blocks 120-123) is repeated.

If the enter key on the keypad 52 has been pressed (block 146), the cash request is processed (beginning with block 148). Likewise, if the processor board 57 times out because no further bills were inserted into the cash acceptor 52 (block 147), the cash request is processed (beginning with block 148). In the described embodiment, the controller board 57 waits for about ten seconds to receive another bill or for the ENTER key to be pressed.

Cash request processing begins with the processor board 57 sending a message to the controller device 24 indicating an end to the cash acceptance sequence (block 148). In turn, the controller device 24 sends a message to the master terminal 19 indicating a cash purchase equaling the total amount of cash accepted has been requested. A prompt "PROCESSING TOTAL \$-.00" is displayed on the LCD display 50 (block 149) indicating to the customer that the island transaction terminal 17 is processing the transaction.

The master terminal 19, upon receipt of the message, remotely enables the pump corresponding to the selected pump number (block 150) by sending the appropriate signals over serial line 27 through the junction box 31 through the underground cable 16a, 16b, 16c, 21a, 21b, 21c corresponding to the appropriate fuel dispensing pump electronics (not shown) in the selected pump. In addition, the master terminal 19 sends a go-ahead message to the controller device 24 which in turn forwards the message to the processor board 57 indicating that the appropriate pump has been enabled. A prompt "GO PUMP AT # \_\_\_\_\_" is displayed on the LCD display 50 (block 151) indicating to the customer that the selected pump has been enabled and is ready for pumping fuel. The processor board 57 pauses for

three seconds (block 152) before clearing the LCD display 50 and returning control to the top of the flow chart to begin another transaction.

The debit card acceptance control path is as follows.

The processor board 57 waits for a debit card to be inserted into the magnetic card reader 53 (for about five seconds in the described embodiment). If the processor board 57 times out (block 124), control returns to the top of the flow chart and the sale is cancelled. Otherwise, if a debit card is inserted (block 124), a prompt "REMOVE CARD" is displayed on the LCD display 50 (block 125) requesting that the customer remove the debit card from the magnetic card reader 53. The processor board 57 waits for the card to be removed from the magnetic card reader 53 (for about five seconds in the described embodiment). If the processor board 57 times out because the card has not been removed (block 126), control returns to the top of the flow chart and the sale is cancelled. Otherwise, if the processor board 57 does not time out (block 126), it then determines whether the magnetic card reader 53 has read the debit card. If the card has not been read (block 127), the processor board 57 determine whether a limit on the number of debit card read attempts has been exceeded. In the described embodiment, a limit of three attempts is used; however, other limits are also acceptable. If the retry limit has not been exceeded (block 128), a prompt "REINSERT CARD" is displayed on the LCD display 50 (block 129) and control returns to the top of the card acceptance cycle (blocks 124-128). Otherwise, if the retry limit has been exceeded (block 122), a prompt "CARD NOT APPROVED USE A DIFFERENT CARD" is displayed on the LCD display 50 (block 130) indicating to the customer that the debit card cannot be read. The processor board 57 pauses for about three seconds (block 131) before clearing the prompt from the LCD display 50, returning control to the top of the

If the card has been read (block 127), a prompt "CARD

"READ" is displayed on the LCD display 50 (block 132) indicating to the customer that the card has been read. Next, a prompt "ENTER PIN #" is displayed on the LCD display 50 (block 133). For security reasons, this prompt is injected into the LCD display 50 by the data encryption module 59. The data encryption module 59 waits for about five seconds for the customer to enter a PIN number. If the data encryption module 59 times out (block 134), control returns to the top of the flow chart and the sale cancelled. Otherwise, if the data encryption module 59 times out (block 134), it obtains a PIN from the customer and verifies that it is correct for the debit card used (block 135). A prompt "PROCESSING" is displayed on the LCD display 50 (block 136) indicating to the customer that the island transaction terminal 17 is processing the requested transaction.

If the data encryption module 59 determines that the PIN is invalid (block 137), it will so indicate to the processor board 57. The processor board 51 determines whether the retry limit has been exceeded (block 138). In the described embodiment a retry limit of three is used; however, other limits are equally acceptable. If the retry limit has not been exceeded (block 138), a prompt "INVALID PIN" is displayed on the LCD display 50 (block 139) indicating to the customer that the PIN is not valid and control returns to the top of the PIN acceptance cycle (blocks 134-138). Otherwise, if the retry limit has been exceeded (block 138), a prompt "'CARD NOT APPROVED USE A DIFFERENT CARD" is displayed on the LCD display 50 (block 142) indicating to the user that the card has not been approved. The controller board 57 pauses for three seconds (block 145) before returning control to the top of the flow chart and cancelling the sale.

If the data encryption module 59 determines that the PIN is valid (block 137), it sends a request to the data bank 69 via the processor board 57, the controller device

24 and the master terminal 19 requesting authorization for a debit from the financial institution that issued the debit card (block 140). The data bank 69 will approve or disapprove the purchase and so indicate to the master terminal 19 which will forward an appropriate message to the controller device 24 and in turn to the processor board 57. If the card has not been approved (block 141), the prompt "CARD NOT APPROVED USE A DIFFERENT CARD" (block 142) is displayed on the LCD display 50 (block 142). The controller board 57 pauses for three seconds (block 145) before returning control to the top of the flow chart and cancelling the sale.

Otherwise, if the card has been approved (block 141), the master terminal 19 enables the appropriate pump corresponding to the selected pump number (block 143) and sends a go-ahead message to the controller device 24 and, in turn, to the processor board 57 indicating that the fuel dispensing pump has been enabled for pumping. The prompt "GO PUMP AT #\_\_\_" is displayed on the LCD display 50 (block 144) indicating to the customer that the pump is ready for use. The processor board 57 pauses for three seconds (block 145) before clearing the LCD display 50 and returning control to the top of the flow chart to begin another transaction.

FIG. 7 is a flow diagram of a procedure for printing a receipt for the method of FIGS. 6A, 6B, 6C and 6D. This procedure is performed when the receipt key on the keypad 51 is pressed (block 102 in FIG. 6A) upon completion of pumping. The receipt printer 54 determines if its paper is jammed or whether it is out of paper. If it is (block 160), the receipt printer 54 so indicates to the processor board 57. A prompt "GO INSIDE FOR RECEIPT" is displayed on the LCD display 50 (block 161) indicating to the customer that the receipt printer 54 on the island transaction terminal 17 is inoperable. The processor board 57 returns control to the top of the flow chart in FIG. 6A to begin a new

transaction. Otherwise, if the receipt printer 54 is functional (block 160), it so indicates to the processor board 57. A prompt "FOR YOUR RECEIPT ENTER PUMP #" is displayed on the LCD display 50 (block 162) indicating to the customer that a pump number must be entered on the keypad 51. If the processor board 57 times out (block 163), control returns to the top of the flow chart in FIG. 6A. Otherwise (block 163), a prompt "PREPARING RECEIPT" is displayed on the LCD display 50 (block 164) indicating to the customer that the appropriate receipt information is being obtained. The processor board 57 sends the receipt data to the receipt printer 54 which then begins printing the receipt (block 165). A prompt "PRINTING RECEIPT" is displayed on the LCD display 50 (block 166). When all of the receipt's data has been sent from the processor board 57 to the receipt printer 54, the processor board 57 sends a signal to the cutter on the receipt printer 54 instructing it to cut the receipt (block 167). This step is optional and only applies when the receipt printer 54 is equipped with a receipt cutter. A prompt "PLEASE TAKE RECEIPT" is displayed on the LCD display 50 (block 168) and a single beep is played on the audio transducer 58 indicating to the customer that the receipt can be removed from the receipt printer 54. A trailer prompt "THANK YOU, COME AGAIN" is displayed on the LCD display 50 (block 169) to indicate that the sale has been completed and the processor board 57 returns control to the top of the flow chart in FIG. 6A to begin a new transaction.

FIGS. 8A, 8B and 8C are a set of flow diagrams depicting asynchronous event handler routines for the method of FIGS. 6A, 6B, 6C and 6D. These routines are performed whenever a particular type of asynchronous action occurs during the course of a transaction as shown in the flow charts of FIGS. 6A, 6B, 6C and 6D. Any of these occurrences could happen at any time and therefore are invoked by the processor board 57 as necessary similar to

a form of interrupt.

FIG. 8A is an asynchronous event handler routine for a sale cancellation. If the cancel key on the keypad 51 is pressed by the customer prior to the authorization of a sale by the master terminal 19 (block 180), the processor board 57 sends the appropriate message to the controller device 24 which forwards it to the master terminal 19; thereby cancelling the sale (block 182). A prompt "SALE CANCELLED" is displayed on the LCD display 50 and three beeps are played on the audio transducer 58 (block 183) indicating to the customer that the sale has been cancelled. The processor board 57 pauses for three seconds before clearing the prompt (block 184) and returning to the top of the flow chart in FIG. 6A to begin a new transaction. Otherwise, if the cancel key was not pressed (block 180), the transaction cycle continues as normal (block 181).

FIG. 8B is an asynchronous event handler routine for an out-of-service instruction. If the attendant using the master terminal 19 programs a pay-at-the-pump terminal 49 on an island transaction terminal 17 out of service (block 190), an appropriate message is sent to the controller device 24 and to the processor board 57 for taking the island transaction terminal out of service (block 192). A prompt "OUT OF SERVICE" is displayed on the LCD display 50 (block 193) indicating to customers that particular point-of-sale terminal 49 is not in service. The processor board 57 waits until the terminal has been returned to service with the appropriate instructions from the master terminal 19 (block 194). Otherwise, the transaction cycle continues as normal (block 191).

FIG. 8C is an asynchronous event handler routine for lost communications. If communications between the register master terminal 19 and the island transaction terminal 17 are lost (block 200), the processor board 57 automatically takes the island transaction terminal 17 out

of service (block 202). A prompt "NOT IN SERVICE" is displayed on the LCD display 50 (block 203). The processor board 57 waits until communications are restored (block 204) before resuming normal operation. Otherwise, the transaction cycle continues as normal (block 201). While various embodiments of the invention have been particularly shown, it will be understood by those skilled in the art that the various changes in form and detail may be made without departing from the scope and spirit of the present invention, wherein:

-24-

**CLAIMS:**

1. An automated method for transacting fuel purchases using an island transaction terminal which controls a plurality of fuel dispensing pumps interconnected to the island transaction terminal through a central attendant terminal, comprising the steps of:

determining whether one of the plurality of fuel dispensing pumps is already reserved by another island transaction terminal or by a central attendant terminal;

accepting money or a money equivalent at the island transaction terminal for a fuel purchase; and

enabling the requested fuel dispensing pump automatically to dispense fuel upon verification of the money or money equivalent acceptance.

2. A method according to claim 1, further comprising the steps of:

collecting money having a plurality of denominations;

counting the money;

maintaining a total of the money accepted; and

enabling the requested fuel dispensing pump to dispense fuel up to an amount corresponding to the money total accepted.

3. A method according to claim 2, further comprising the step of terminating the step of accepting money when the money total reaches a predetermined limit.

4. A method according to claim 2, further comprising the step of rejecting worn out or invalid paper money without having to adjust the money total.

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5. A method according to claim 2, further comprising the step of indicating to the central attendant terminal that there is a jam of paper money.

6. A method according to claim 1, further comprising the steps of:

accepting a money equivalent represented by a removable indicator;

obtaining authorization information from the money equivalent;

verifying proper authorization in response to entry of appropriate data and comparing the obtained data to the authorization information; and

determining an authorization amount; and

enabling the requested fuel dispensing pump to dispense fuel up to an amount not to exceed the authorization amount.

7. A method according to claim 6, further comprising the steps of:

reading the authorization information off a card; and comparing the appropriate data to the read authorization information.

8. A method according to claim 7, further comprising the step of:

communicating the read authorization information to a remote data bank; and

approving the cash equivalent for a debit as payment for the fuel purchase.

9. A method according to claim 1, further comprising the steps of:

collecting information regarding the fuel

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purchase; and  
printing the information on a receipt.

10. A method according to claim 9 further comprising the step initiating the step of collecting when the fuel dispensing has completed.

11. A method according to claim 9, wherein the receipt is printed on paper, said method further comprising the steps of:

sensing a jammed paper condition;

sensing a low paper condition; and

indicating the jammed paper condition or the low paper condition automatically to the central attendant terminal.

12. A computer-usable memory encoded with instructions for transacting fuel purchases using an island transaction terminal which controls a fuel dispensing pumps interconnected to the island transaction terminal through a central attendant terminal, comprising:

means for determining whether one of the plurality of fuel dispensing pumps is already reserved by another island transaction terminal or by a central attendant terminal;

means for accepting money or a money equivalent at the island transaction terminal for a fuel purchase; and

means for enabling the requested fuel dispensing pump automatically to dispense fuel upon verification of the money or money equivalent acceptance.

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13. A method for transacting fuel purchases on a fuel dispensing island using an island transaction terminal comprising a cash payment acceptor or a non-cash payment acceptor or both a cash payment acceptor and a non-cash payment acceptor, comprising the steps of:

accepting a pump number for identifying one of a plurality of fuel dispensing pumps at the island transaction terminal;

determining whether the fuel dispensing pump corresponding to the pump number is already reserved by another island transaction terminal or by a central attendant terminal;

reserving the corresponding fuel dispensing pump;

accepting a cash or non-cash payment at the island transaction terminal; and

enabling automatically the corresponding fuel dispensing pump to dispense fuel.

14. A method according to claim 13, further comprising the step of accepting a cash payment in a plurality of acceptable currency denominations.

15. A method according to claim 13, further comprising the step of accepting a debit card as the cash equivalent for drawing on cash on deposit.

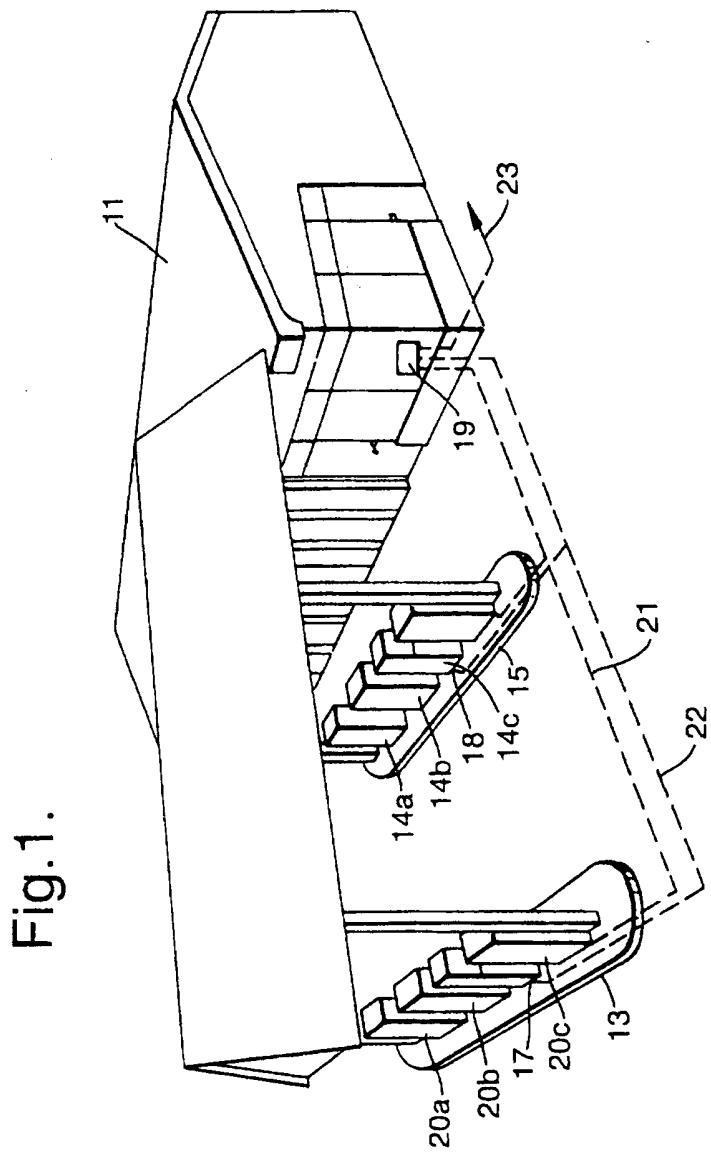


Fig. 1.

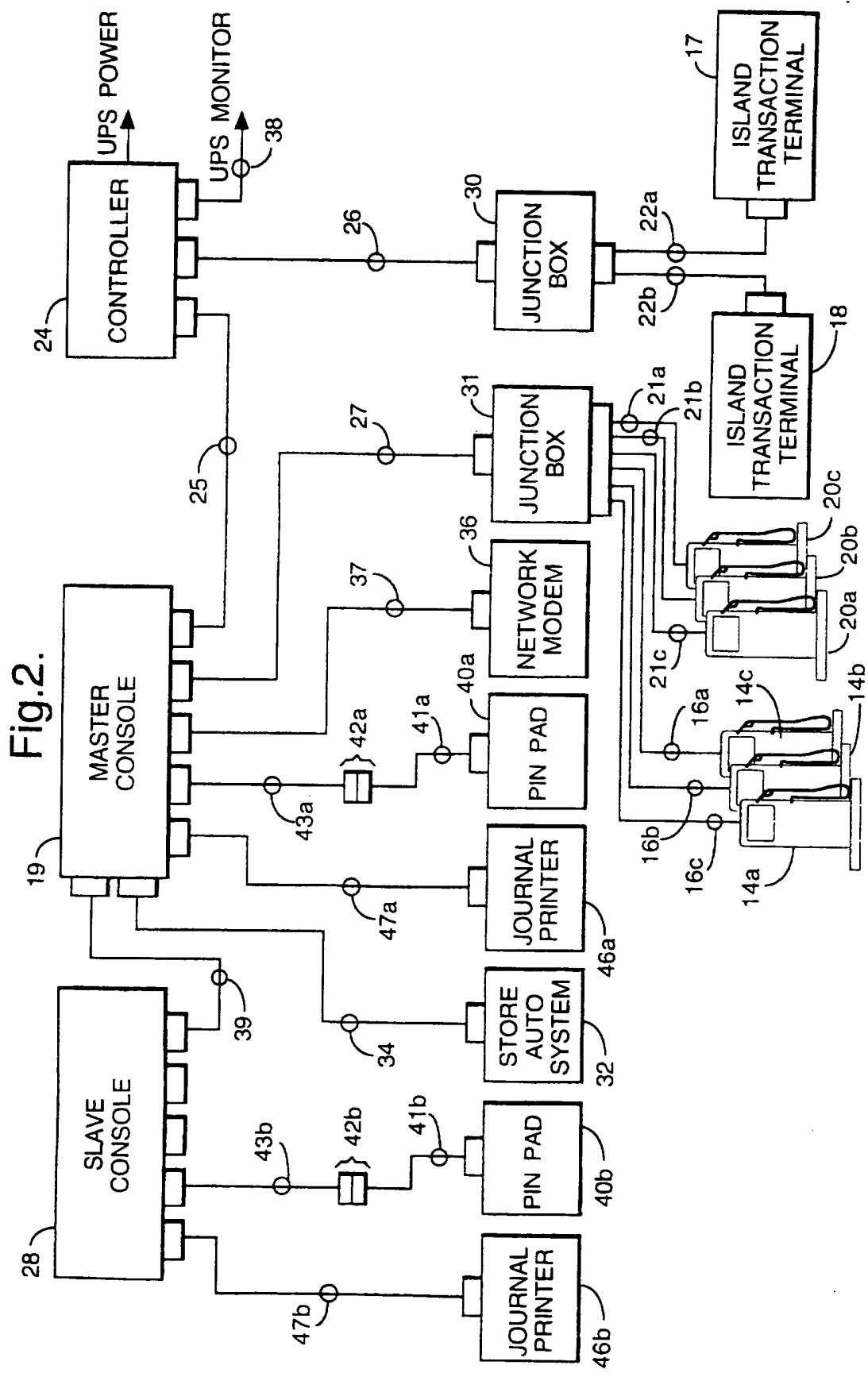


Fig.3.

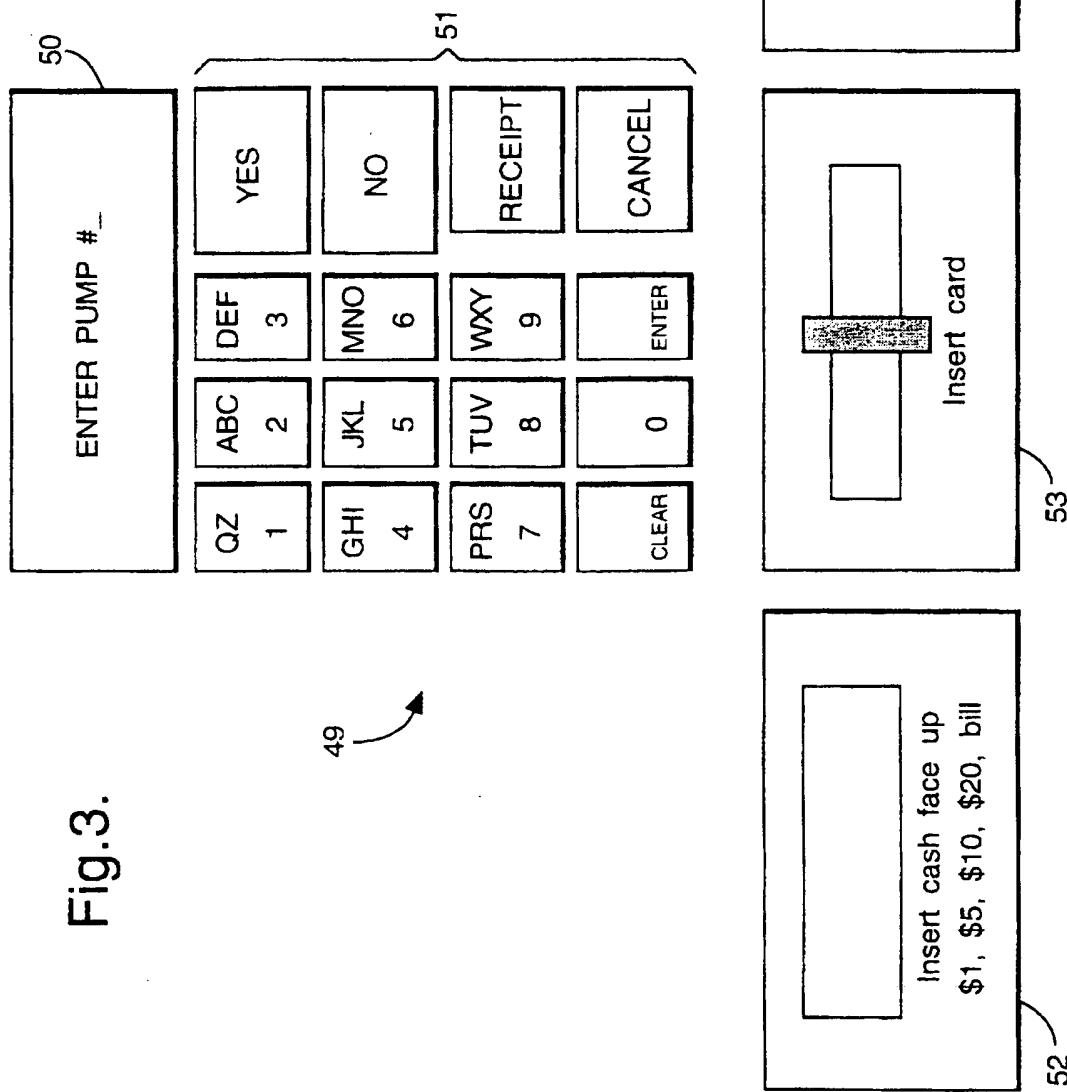


Fig.4. DISPENSER CONTROLLER

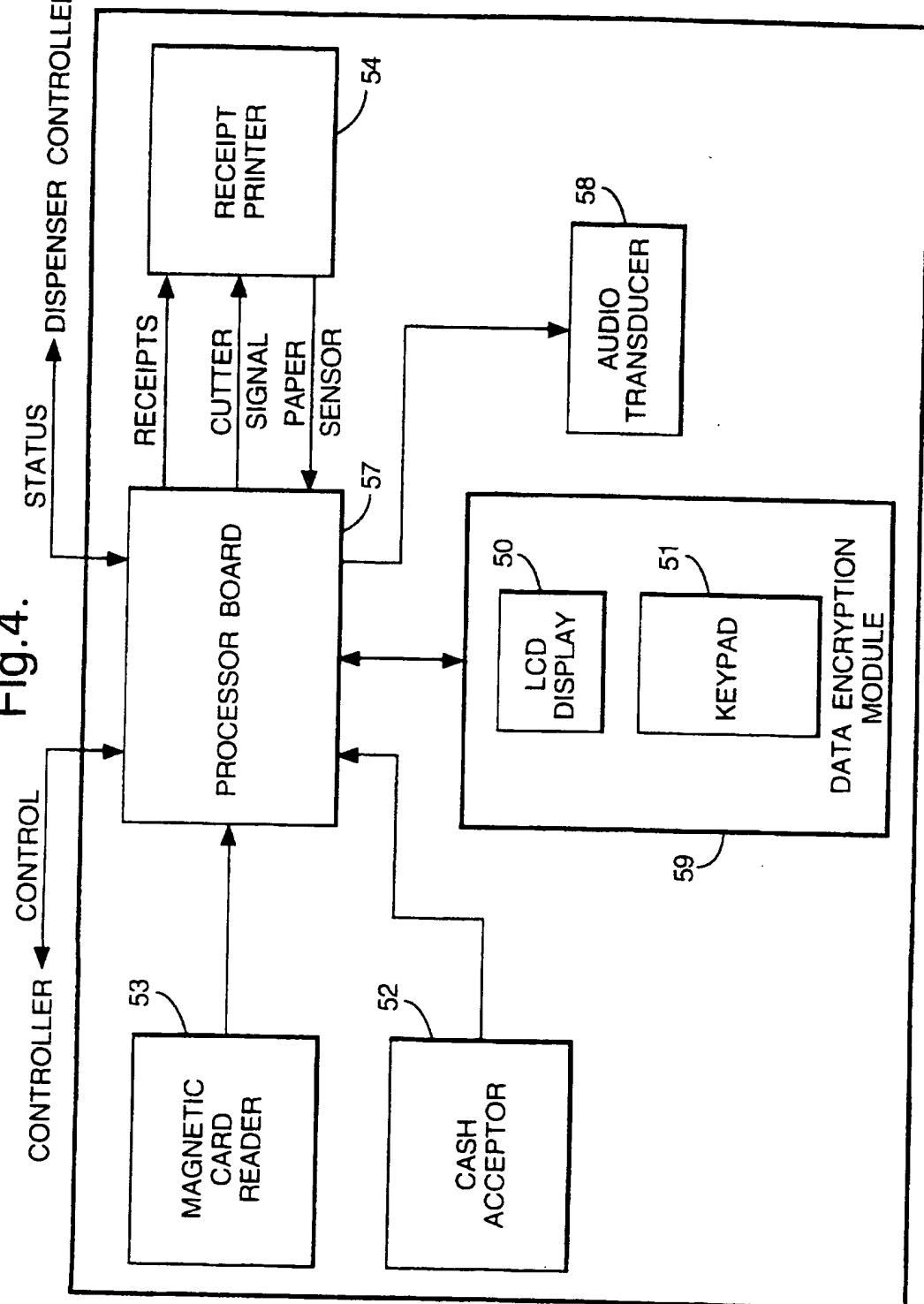
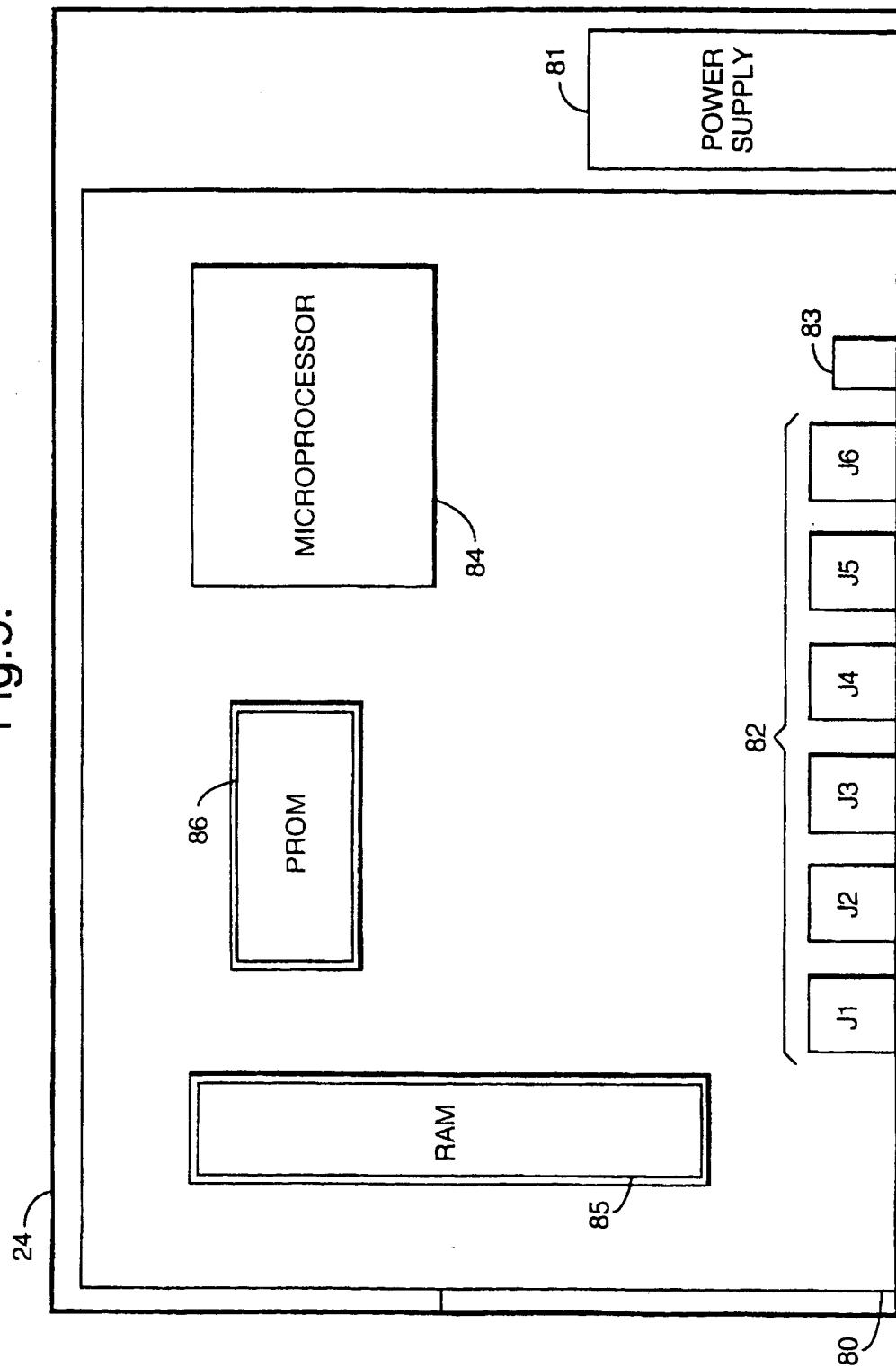


Fig.5.



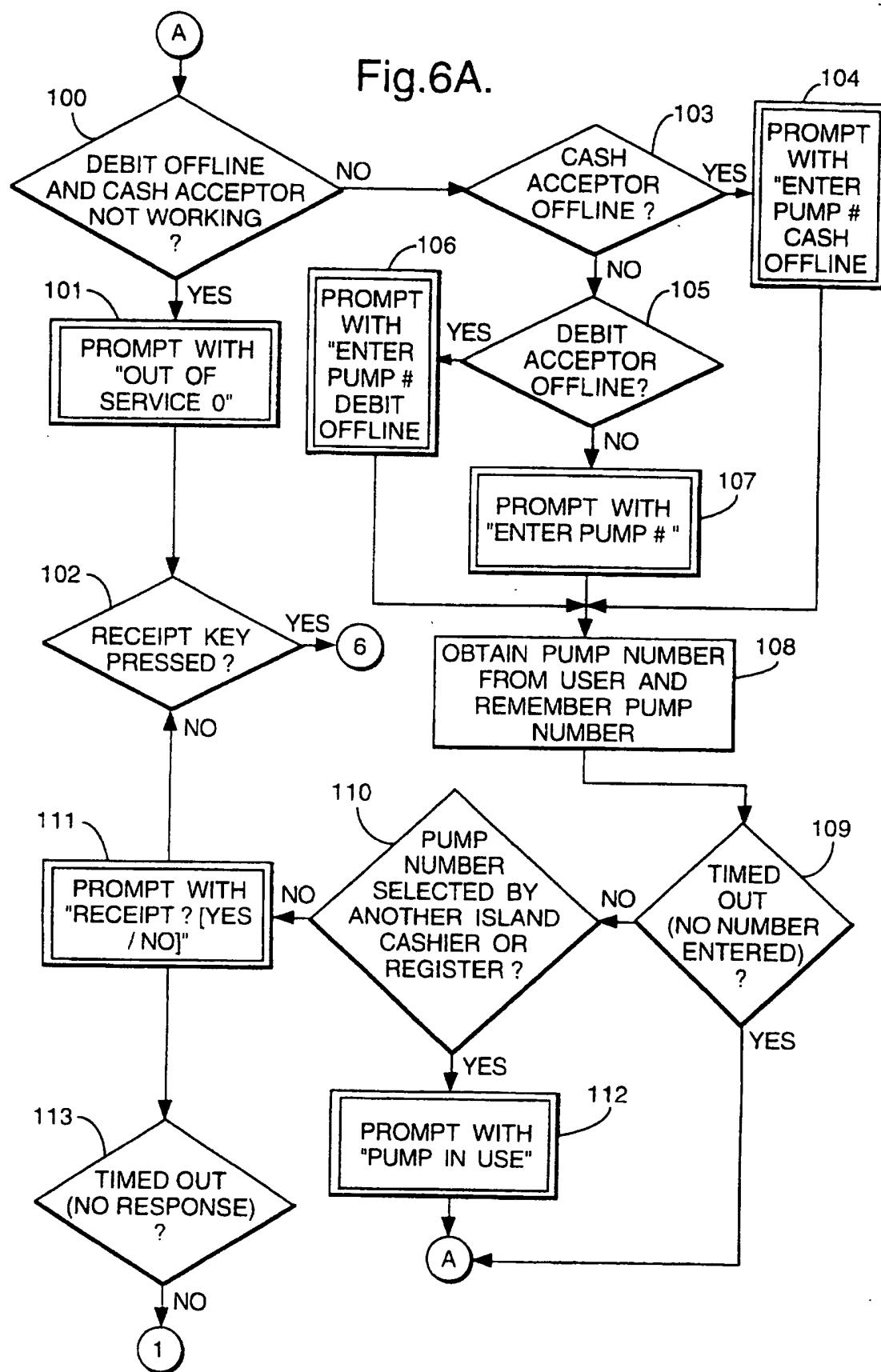
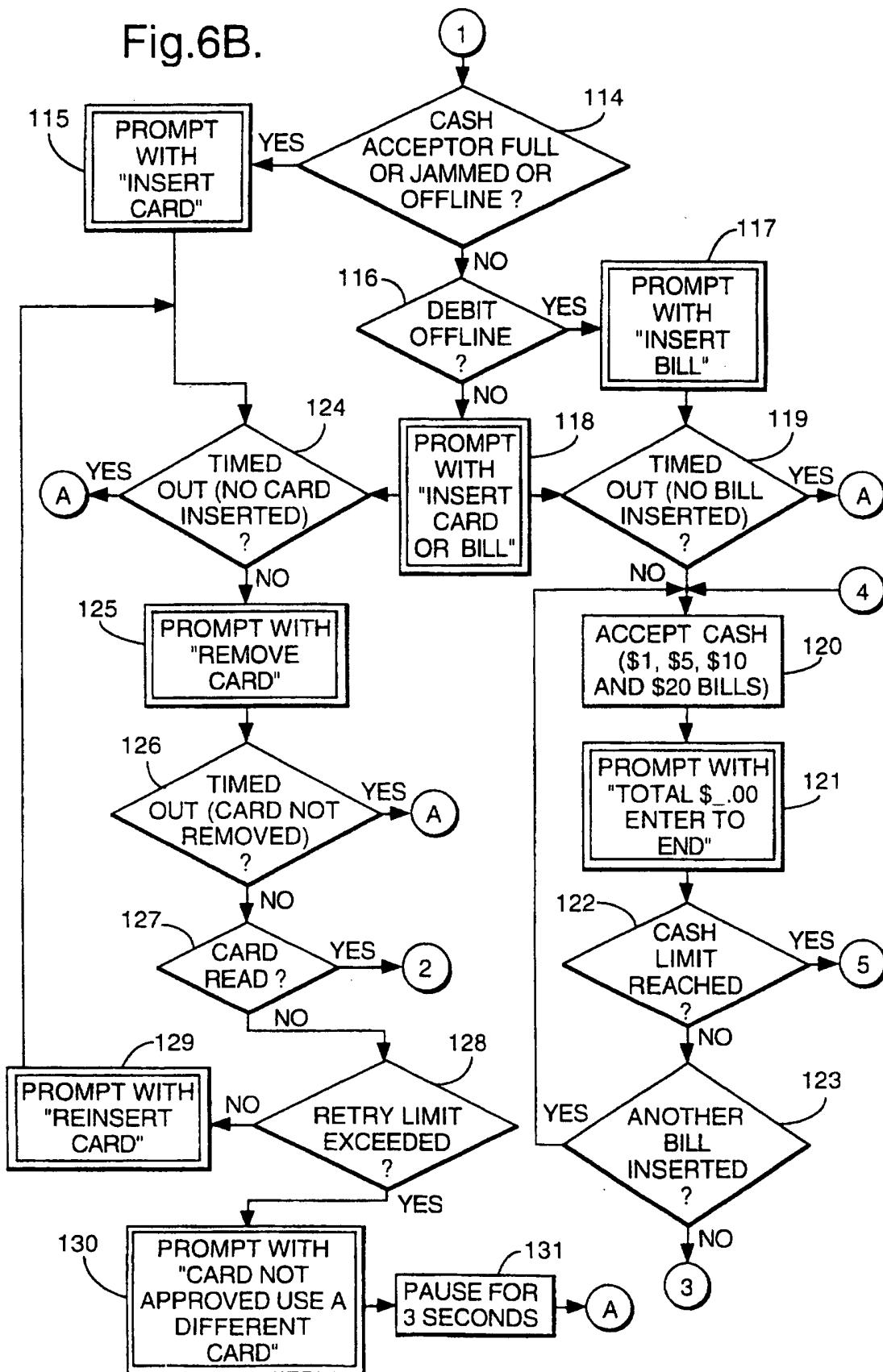


Fig.6B.



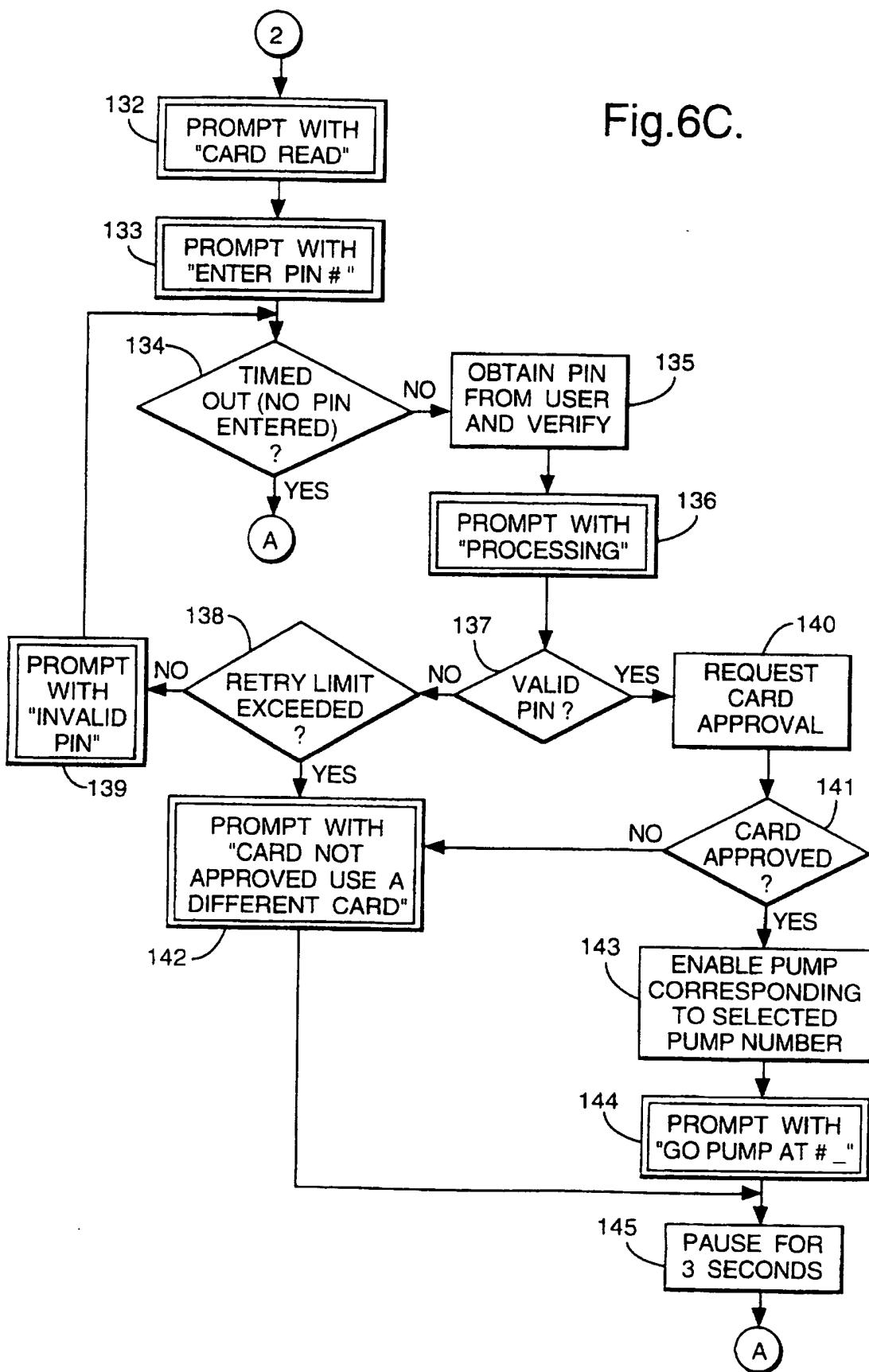


Fig.6D.

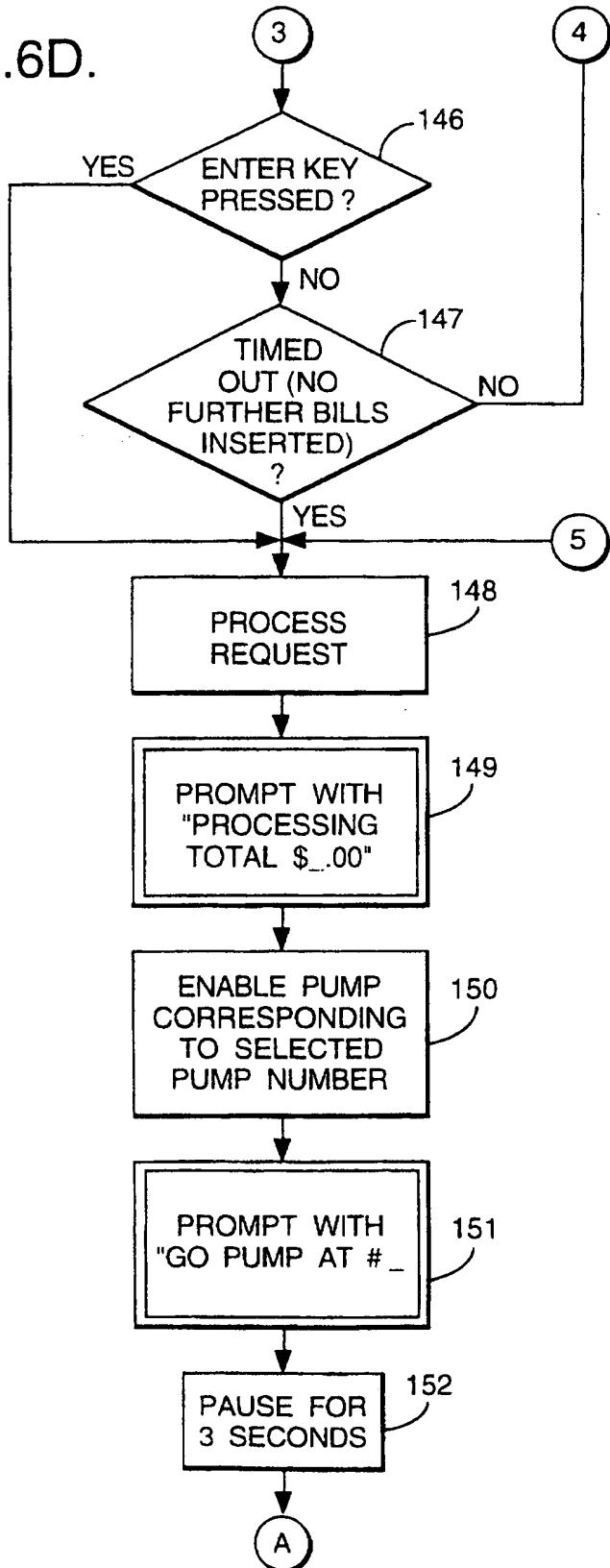
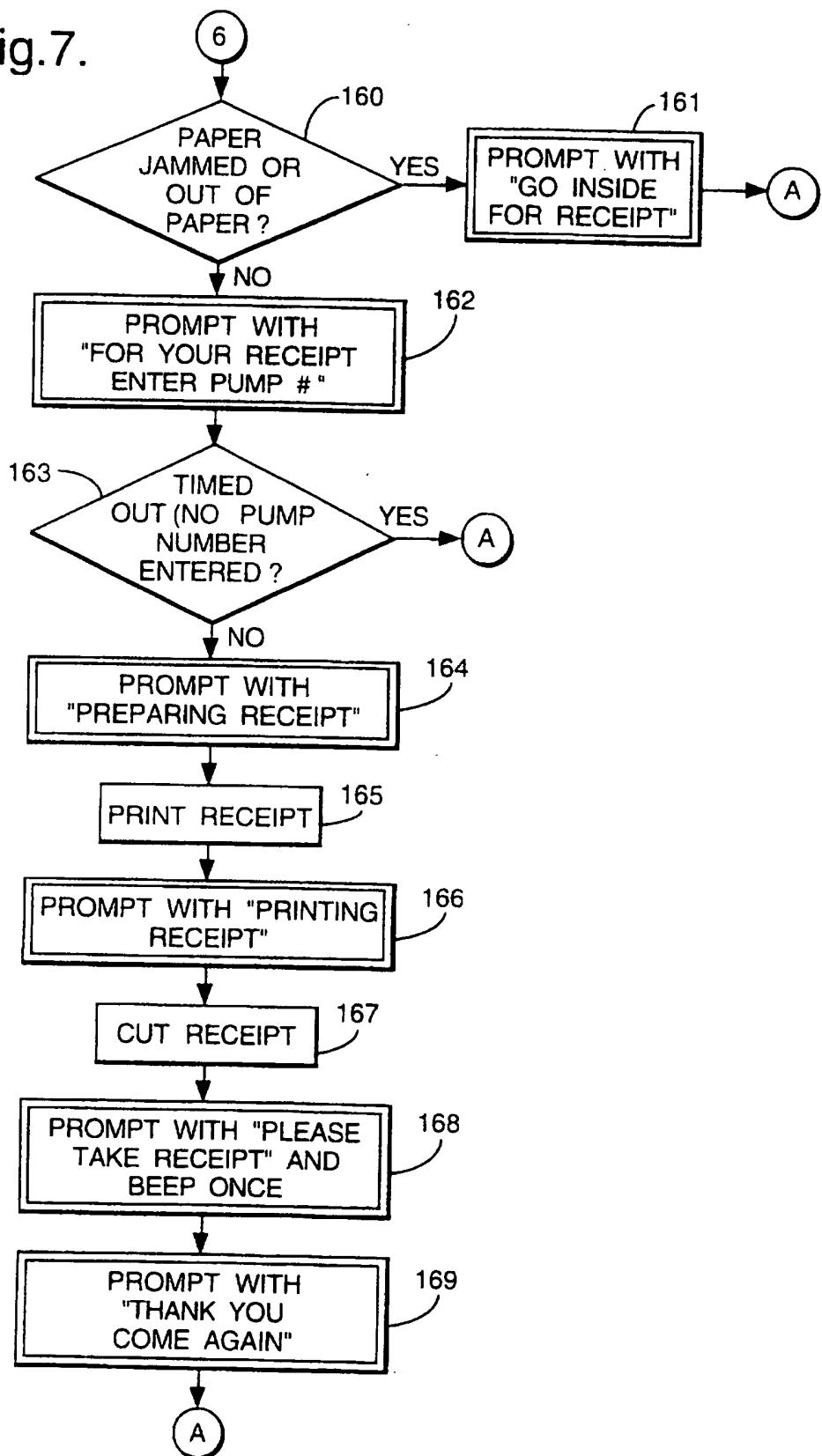


Fig.7.



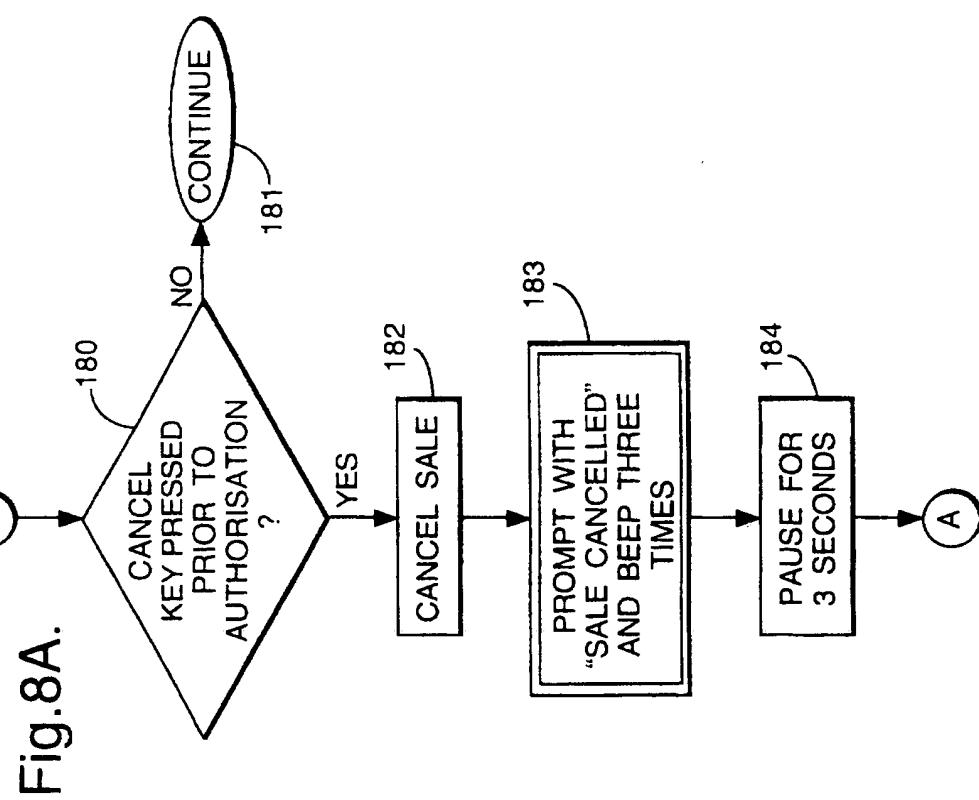
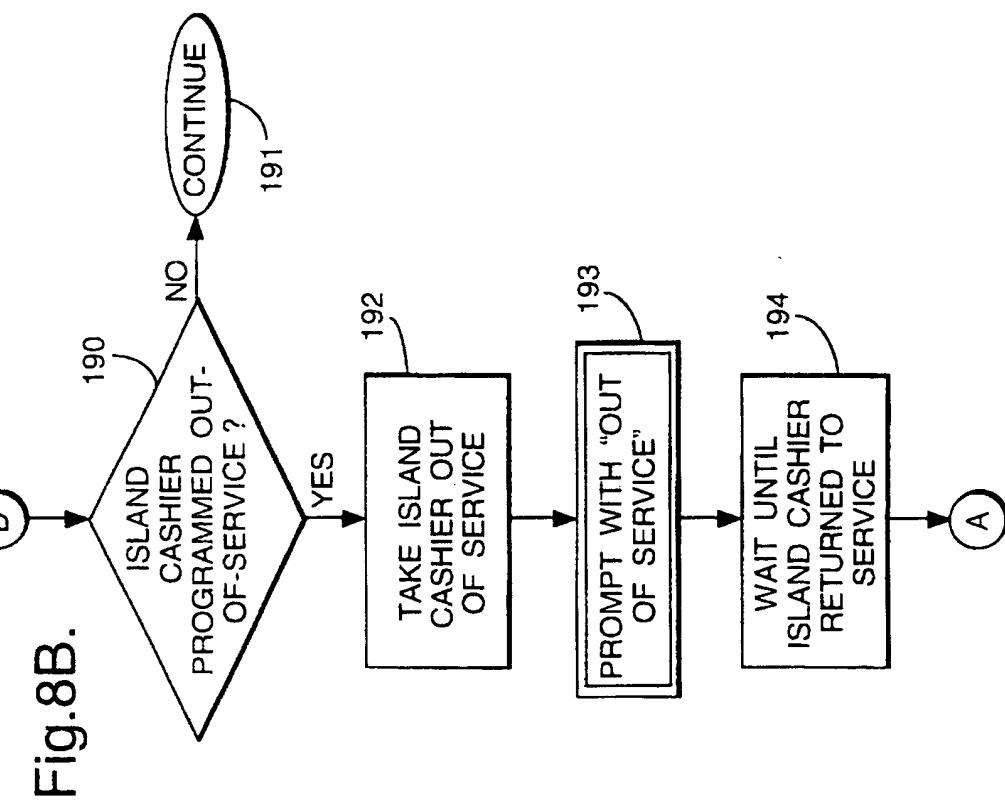
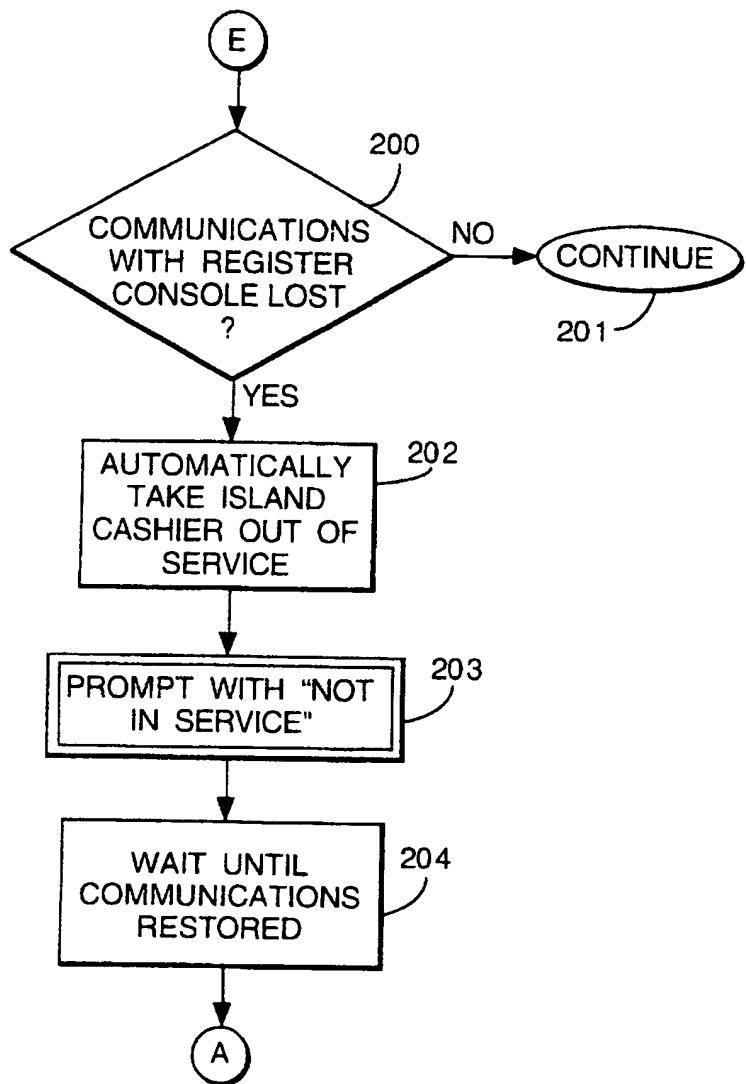


Fig.8C.



# INTERNATIONAL SEARCH REPORT

International Application No  
PCT/GB 96/02957

**A. CLASSIFICATION OF SUBJECT MATTER**  
IPC 6 G07F13/02

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)  
IPC 6 G07F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 3 931 497 A (GENTILE FRED J ET AL) 6 January 1976	1,2,12, 13,15
A	see claim 1; figure 1 ---	3-11,14
A	US 4 395 627 A (BARKER THOMAS H ET AL) 26 July 1983 cited in the application see claim 1; figure 1 ---	1-15
A	DE 35 07 707 A (WARTUNGS UND PRUEFUNGSDIENST G) 11 September 1986 see claim 1; figure 1 ---	1-15
A	US 4 199 100 A (MOORE ROBERT A ET AL) 22 April 1980 see claim 1; figure 1 ---	1-15
		-/-

Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

\* Special categories of cited documents :

- \*A\* document defining the general state of the art which is not considered to be of particular relevance
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- \*O\* document referring to an oral disclosure, use, exhibition or other means
- \*P\* document published prior to the international filing date but later than the priority date claimed

- \*T\* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- \*X\* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- \*Y\* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
- \*&\* document member of the same patent family

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Date of the actual completion of the international search

21 March 1997

Date of mailing of the international search report

02.04.97

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## INTERNATIONAL SEARCH REPORT

Inte	inal Application No
PCT/GB 96/02957	

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 94 09458 A (GILBARCO LTD) 28 April 1994 see claim 1; figure 3 -----	1-15

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# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/GB 96/02957

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